MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF VASSAR COLLEGE

XIV. AN EFFECT OF FATIGUE ON JUDGMENTS OF THE AFFECTIVE VALUE OF COLORS

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A state of fatigue may naturally be expected to lessen the pleasantness of pleasant experiences and to increase the unpleasantness of unpleasant experiences. The present study is an attempt to get experimental confirmation, within a certain very limited sphere, of this conclusion drawn from general experience. As the source of pleasant and unpleasant affection we chose colored papers. With regard to the source of fatigue, evidently a number of possibilities were open: we might have used some form of physical fatigue, but we chose mental fatigue instead. Here, again, we might have produced fatigue in our observers by means of some kind of mental work, such as mental arithmetic, quite different from the work of judging the affective values of colors. We undertook, however, the problem of finding how far judgments of the affective value of colors are influenced when the observer is required to perform a long series of such judgments. That is, the fatigue was produced by the same kind of mental process as that upon which it was supposed to act.

Our method was as follows: A piece 2.9 cm. square was cut from each of the ninety colored papers in the Bradley series, comprising eighteen saturated colors, namely, red violet, violet, blue violet, violet blue, blue, green blue, blue green, green, yellow green, green yellow, yellow, orange yellow, yellow orange, orange, red orange, orange red, red, violet red; together with two shades and two tints of each color. Each piece of paper was placed on a white background before the observer, who was required to look at it for ten seconds and to record her judgment of its affective value in numerical terms, using the numbers from 1 to 7 to designate respectively the following degrees: very unpleasant, moderately unpleasant, slightly unpleasant, indifferent, slightly pleasant, moderately pleasant, very pleasant. The colors were shown in wholly irregular order. After judgment had been passed upon the whole ninety, without any pause in the operations the observer was given in succession the first six colors of the experimental series, in their original order, and required to record anew her judgment of their pleasantness or unpleasantness. In no case did the observer report remembering what her previous judgment had been. The whole proceeding took from three-quarters of an hour to an hour. The effect of fatigue upon the affective tone of the six colors selected to begin the series was then calculated as follows. When the number assigned to a color at the end of the series differed from the number assigned to the same color at the beginning, the amount of the difference together with its sign, *i. e.*, whether it was an increase or a decrease, was noted, and these differences were averaged, regard being paid to signs. Thus for one observer the affective value of one of the six colors dropped two numbers, that of another color dropped one number, that of a third rose one number, and that of three colors showed no change. The total change for all the colors tested was then 1—3, or—2; and dividing this number by 6, the number of colors tested, we find the average fall in affective value to be .3.

There were thirty-five observers, all women and all but four college students. Out of these, the averages of seven showed a rise instead of a fall in the affective value of the colors at the end of the series, and for three the affective values were exactly the same at the beginning and at the end. Twenty-three observers show an average drop of from .1 to 1.5. In the case of three observers every change in the affective value of a color was an increase: in the case of ten, every change was a decrease.

It is unnecessary to point out that we cannot be sure of producing uniform degrees of fatigue by this method. Aside from individual differences in physical condition and previous fatigue, the process of judging required is undoubtedly more fatiguing to some people than to others. Thus one of the three observers for whom the affective values were greater at the end than at the beginning of the series was an artist, to whom the colors had probably more interest than to the other observers. Again, in the case of those observers who were acquainted with the method the knowledge that the end of the series was approaching produced a cheering up which might have been expected to counterbalance fatigue; although this did not prove to be the case with two out of the three authors of this study. When a drop in the affective value of a color does appear at the end of the series, we have no assurance that it is produced by fatigue; but since the other sources of variation might be expected to produce a rise as often as a drop, the results do indicate that *for sixty-five per cent. of our observers fatigue was the prevailing source of change.*

Two further facts may be noted. The total number of points by which the saturated colors were raised in affective value at the end of the series was 29; the total number of points by which they were lowered was 35; the excess of lowering over raising is then only 6. The corresponding excess for tints is 31, and for shades, 40. Shades, tints, and saturated colors were selected with about equal frequency for use as the test colors at the beginning and end of the experimental series. These results, then, seem to mean that *under the experimental conditions described, the effect of fatigue in lowering affective value is very decidedly less marked in the case of saturated colors than in that of shades and tints.* On the other hand, the variations from other sources than fatigue seemed to influence saturated colors, shades, and tints to nearly the same degree, if we may judge from the fact that the percentage of cases where the affective value of a color was the same at the beginning as at the end of a series was, for saturated colors, 40; for tints, 34, and for shades, 45. It looks, however, as though the affective impression made by saturated colors, whether pleasant or unpleasant, were so definite that fatigue induced by this method alters it but little; although we might expect that *continuous* experience with a saturated color would cause a rapid drop in its pleasantness.

Secondly, we undertook to find what kind of judgments were most influenced by fatigue. When we counted the number of times each numerical judgment from 2 to 7 appeared in connection with the first six colors of the series, and found in what percentage of this number the judgments were lowered at the end of the series, there appeared to be no uniform relation between the degree of pleasantness or unpleasantness in the first experience and the amount of lowering of affective value in the second. We noted that other sources of variation appeared to affect extreme judgments, 1 and 7, more than moderate judgments: the percentage of cases involving no change whatever in affective value was highest for the judgments 7 and 1. We at first thought that this result pointed to a conclusion regarding the variability of a given individual's affective reaction to a given color, which might be expressed in some such terms as that we are less likely to change our minds with regard to the objects of our extreme likes and dislikes than with regard to those which produce more moderate affective reactions. But later reflection showed us that the real cause of

the fact that the extreme judgments appeared to be more constant than the moderate ones lay in the conditions of the experiment. If the first judgment upon a color has been a moderate one, there are three possibilities with regard to the second: it may express the same affective value as the first, or a greater affective value, or a less one. If on the other hand the first judgment has assigned either the highest or the lowest affective value to a color, there are only two possibilities with regard to the second judgment: it may be the same as the first, or it may vary from it in one direction only. It naturally follows that the percentage of cases showing no change will, if there is no constant tendency present, be greater where the first judgment has assigned the highest or the lowest affective values.

XV. A Note on the Affective Values of Colors

By M. F. Washburn

In the preceding study each of thirty-five observers was required to record in numerical terms her judgment on the pleasantness or unpleasantness of ninety colors, each color being presented in the form of a paper square 2.9 cm. a side, on a white background, and looked at for ten seconds. From the results thus obtained the verdicts of the different observers on a given color have been selected out, and their average calculated together with the mean variation. The whole series contained ninety saturated colors besides two tints and two shades of each color. To avoid what seemed unnecessary labor, the calculations to be discussed were made only for the lighter tint and the darker shade of each color: thus for eighteen tints and eighteen shades.

It appears that for our thirty-five observers, all women and nearly all college students, *the affective value of the tints is highest* (average from all observers, 4.7); *that of the shades is next* (average from all observers, 4.1), *and that of the saturated colors is lowest* (average from all observers, 3.6). Further, that *the affective reaction to saturated colors*, whether pleasant or unpleasant, *is more positive than that to shades and tints, and that to tints more positive than that to shades*, is indicated by the fact that the total number of judgments '4' (indifferent) is for saturated colors, 50; for tints, 89, and for shades, 101.

Among saturated colors, the order of increasing pleasantness, together with the average affective value assigned to each color by our observers, is as follows: green yellow, 2.1; orange and yellow green, 2.6; red violet and green, 3; yellow, 3.3; yellow orange and blue green, 3.4; red orange, 3.6; violet red, 3.7; violet blue and blue, 3.8; orange yellow and blue violet, 4; violet, 4.4; orange red, 4.5; green blue, 5.3; red, 5.6. *Pure red is the pleasantest saturated color, and green blue comes next. There is a tendency to dislike yellows and yellow greens.*

Among tints, the order of increasing pleasantness is the following: violet red, 3.4; green yellow, 3.8; orange, 4.3; yellow and orange yellow, 4.4; yellow orange, 4.5; blue green, red orange, and red, 4.6; green blue and orange red, 4.7; green, 4.3; yellow green, 5; violet blue, 5.1; blue violet, 5.5; red violet and violet, 5.9; blue, 6. *Blue is the pleasantest light tint, and indeed the pleasantest color in the whole series.*

Among shades, we have the following order of increasing pleasantness; yellow, 2.3; orange yellow, 2.7; blue green, 3.7; red violet, green yellow, yellow orange, and orange, 3.8; violet red, 3.9; red orange and orange red, 4.3; violet, 4.4; blue violet, green blue, and green, 4.5; red and violet blue, 4.8; blue, 5; yellow green, 5.3. *Yellow green is the pleasantest dark shade and blue comes next.*

It might seem that a study of the mean variations of these averages